भारतीय मानक
Indian Standard

IS 17191 (Part 3) : 2019

विद्युत पावर ट्रेन वाहन

भाग 3 कुल पॉवर तथा 30 मिनट की अधिकतम पॉवर मापना

Electric Power Train Vehicles

Part 3 Measurement of Net Power and the Maximum 30 Minute Power

ICS 43.120

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June 2019 **Price Group 3**

Electric and Hybrid Vehicles Sectional Committee, TED 27

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Electric and Hybrid Vehicles Sectional Committee had been approved by Transport Engineering Division Council.

This standard prescribes the requirements for the measurement of net power and maximum 30 min power of electric power train vehicles. In the formulation of this standard considerable assistance has been drawn from:

AIS 041 (Rev 1) : 2015 Electric Power Train Vehicles — Measurement of net power and the maximum 30 minute power

AIS 049 : 2016 Electric Power Train Vehicles — CMVR Type Approval for Electric Power Train Vehicles Central Motor Vehicles Rules, 1989 (as amended from time to time) Doc No MoRTH/ TAP/ CMVR - 115/116 (Issue no 4)

In case of any variance between the standard and Central Motor Vehicles Rules, 1989 (as amended from time to time), latter shall prevail. Following document may be referred for latest update on statutory requirements related to Battery Operated Vehicles.

Central Motor Vehicles Rules, 1989 (as amended from time to time)

The composition of the committee responsible for the formulation of this standard is given at Annex A.

In reporting the results of a test or analysis made in accordance with this standard, is to be rounded off, it shall be done in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.

Indian Standard

ELECTRIC POWER TRAIN VEHICLES

PART 3 MEASUREMENT OF NET POWER AND THE MAXIMUM 30 MINUTE POWER

1 SCOPE

This standard (Part 3) applies to the representation of the curve as a function of motor speed and the power at full load indicated by the vehicle/motor manufacturer for motors of electric drive trains and the maximum 30 min power of electric drive trains intended for the propulsion for L, M and N categories of electric power train vehicles.

2 REFERENCES

IS No.	*Title*
14272 : 2011	Automotive vehicles — Types — Terminology
17192 (Part 1) : 2019	Electric power train vehicles: Part 1 Measurement of electrical energy consumption

3 DEFINITIONS

For the purpose of this standard the definitions given in IS 17192 (Part 1) in addition to definitions given in IS 14272 shall apply.

4 TEST CONDITIONS

4.1 The test for motor power may be conducted by testing the motor using a bench dynamometer or by testing the vehicle using a chassis dynamometer as per manufacturer’s option.

4.2 The motor /vehicle shall have been run-in according to the manufacturer’s recommendations.

4.3 If the power measurement can be carried out only on a motor with the gear box or a reducer mounted, the efficiency shall be taken into account.

5 TESTING PROCEDURE

5.1 Bench Dynamometer Procedure

5.1.1 *Auxiliaries*

5.1.1.1 *Auxiliaries to be fitted*

During the test, the auxiliaries necessary for the motor operation in the intended application as listed in Table 1 shall be installed in the same position as in the vehicle.

5.1.1.2 *Auxiliaries to be removed*

The auxiliaries necessary for the proper operation of the vehicle, and which may be mounted on the motor shall be removed when performing the test. The following non-exhaustive list is given as an example:

a) Air compressor for brakes;
b) Power steering compressor;
c) Suspension system compressor; and
d) Air conditioner system, etc.

5.1.1.3 Where accessories cannot be removed, the power they absorb in the unloaded condition may be determined and added to the measured power.

The electric motor shall be supplied from a d.c. voltage source with a maximum voltage drop of 5 percent depending on time and current (periods of less than 10 s excluded). The supply voltage of the test shall be as specified by the vehicle manufacturer.

5.2 Chassis Dynamometer Procedure

5.2.1 While testing the vehicle on chassis dynamometer, the chassis dynamometer shall be adjusted for canceling the friction losses from the parts of the running vehicle other than the electric power train and the installed accessories. This may be carried out by calibrating the chassis dynamometer by coast down with the vehicle placed on the chassis dynamometer appropriately.

5.2.2 The power supply may be as given in Table 1 or may be from the rechargeable energy storage system (REESS) of the vehicle. In such case, the voltage shall be maintained within the specified limits by supplying energy to the REESS using the power supply given in Table 1.

5.2.3 If the power supply is from the REESS of the vehicle, the REESS shall be charged according to the normal charge procedure for a period not exceeding 12 h or as per vehicle manufacturer’s recommendation [*see* **4.5.2.1** of IS 17192 (Part 1)] .

5.3 Setting Conditions

The setting conditions shall conform to the manufacturers specifications for the production motor and be used without further alteration for the particular application.

Table 1 Auxiliaries to be Fitted for the Test to Determine Net Power and the Maximum 30 min Power of Electric Motor

(‘Standard-production equipment’ means equipment provided by the manufacturer for a particular application).

No.	Auxiliaries	Fitted for net power and the maximum 30 min power test
1	d.c. voltage source	Voltage drop during test less than 5 percent
2	Speed variator and control device	Yes: Standard-production equipment
3	Liquid cooling	
	Motor bonnet	No
	Bonnet outlet	No
	Radiator[1),2)]	Yes : Standard production equipment
	Fan	Yes : Standard production equipment
	Fan cowl	Yes : Standard production equipment
	Pump	Yes : Standard production equipment
	Thermostat[3)]	Yes : Standard production equipment
	Air Cooling	
	Air filter	Yes : Standard production equipment
	Cowl	Yes : Standard production equipment
	Blower	Yes : Standard production equipment
	Temperature adjustment system	Yes : Standard production equipment
4	Electrical equipment	Yes : Standard production equipment
5	Bench test auxillary fan	Yes, if necessary

[1)] The radiator, the fan, the fan cowl, the water pump and the thermostat shall be located on the test bench in the same relative position as on the vehicle.

The cooling-liquid circulation shall be activated by the motor liquid pump only. Cooling of the liquid may be produced either by the motor radiator, or by an external circuit, provided that the pressure loss of this circuit and the pressure at the pump inlet remain substantially the same as those of the motor cooling system.

The radiator shutter, if any, shall be in the open position. Where the fan, radiator and fan cowl cannot conveniently be fitted for the bench test, the power absorbed by the fan when separately mounted in its correct position in relation to the radiator and cowl (if used), shall be determined at the speed corresponding to the motor speeds used for measurement of the motor power either by calculation from standard characteristics or by practical tests.

This power, corrected to the standard atmospheric conditions should be deducted from the correct power.

[2)] Where a dis-connectable or progressive fan or blower is incorporated, the test should be carried out with the fan (or blower) disconnected or at maximum slip condition.

[3)] The thermostat may be fixed in the fully open position.

5.4 Data to be Recorded

5.4.1 The test for determining the net power shall be carried out with the speed control set at the maximum position with full setting of the power controller.

5.4.2 Torque and speed data shall be recorded simultaneously.

5.4.3 If needed, the cooling liquid temperature recorded at the motor outlet must be maintained at ± 5°C of the thermostat temperature setting specified by the manufacturer

For air cooling motor, the temperature at a point indicated by the manufacturer shall be kept within + 0/ - 20°C of the maximum value specified by the manufacturer.

5.4.4 The temperature of the lubricating oil measured in the oil sump or at the outlet from the oil temperature exchanger (if any) shall be maintained within the limits prescribed by the manufacturer

5.4.5 An auxiliary regulating system may be used, if necessary, to maintain the temperature within the limits specified in **5.4.3** and **5.4.4**.

5.5 Accuracy of Measurements

5.5.1 *Torque, 1 Percent of Measured Torque*

The torque measuring system shall be calibrated to take friction losses into account. The accuracy in the lower half of the measuring range of the dynamometer bench may be ± 2 percent of measured torque.

5.5.2 *Motor Speed. 0.5 Percent of Measured Speed*

5.5.3 *Motor Inlet Air Temperature, ± 2°C*

5.5.4 *Vehicle Speed, ± 1 kmph*

6 DETERMINATION OF NET POWER

6.1 The motor/vehicle and its entire equipment assembly must be conditioned at a temperature of 25° ± 5°C for a minimum of two hours before start of test.

6.2 The net power test shall consist of a run at full setting of the power controller.

6.3 Just before beginning the test, the vehicle/motor shall be run on the chassis/bench dynamometer for three minutes delivering a power equal to 80 percent of the rated maximum power at the speed recommended by the manufacturer

6.4 Measurements shall be taken at a sufficient number of motor speeds, (at least four) to define correctly the power curve between lowest and the highest speeds recommended by the manufacturer

6.5 The whole test shall be completed within 5 min. It may be necessary to recharge the batteries once for completion of the power curve measurement.

7 DETERMINATION OF MAXIMUM 30 MINUTE POWER

7.1 The motor/vehicle and its entire equipment assembly must be conditioned at a temperature of 25° ± 5°C for minimum four hours before the test.

The electric motor/vehicle shall be run on the bench dynamometer/chassis dynamometer at a power, which is declared by manufacturer for the maximum 30 min power.

The speed is recommended to be in a range, at which the net power is greater than 90 percent of the maximum power measured in **6**. This speed shall be recommended by the manufacturer.

7.2 Speed and power shall be recorded. The power must be in a range of ± 5 percent of the power value at the start of the test. The maximum 30 min power is the average of the power within the 30 min period.

8 TEST RESULTS

8.1 The net power and the maximum 30 min power for electric power train vehicles/motor indicated by the manufacturer shall be accepted if it does not differ by more than ± 2 percent for maximum power and more than ± 4 percent at the other measurement points on the curve with a tolerance of ± 1 kmph for vehicle speed or ± 2 percent of the motor speed or motor speed range (X_1 min^{-1} + 2 percent) to (X_2 min^{-1} - 2 percent) ($X_1 < X_2$), from the values measured by the test agency.

NOTE — If the battery limits the maximum 30 min power, the maximum 30 min power of an electric vehicle can be less than the maximum 30 min power of the motor of the vehicle according to this test.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Electric and Hybrid Vehicles Sectional Committee, TED 27

Organization	*Representative(s)*
International Centre for Automotive Technology (ICAT), Gurgaon	Shri Dinesh Tyagi (***Chairman***)
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Association of State Road Transport Undertakings, New Delhi	Shri R Chandrababu Shri Ullas Babu (*Alternate*)
Automotive Research Association of India, Pune	Shri Anand A. Deshpande Shrimati Ujjwala S. Karle (*Alternate*)
Automotive Component Manufacture Association, New Delhi	Shri Uday Harite Shrimati Seema Babal (*Alternate*)
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Mahindra Research Valley, Chennai / Mahindra & Mahindra, Nasik	Shri Kumarprasad Telikepalli Shri Shailesh V Kulkarni (*Alternate*)

Organization	*Representative(s)*
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